# ICTS Statistical Physics & Condensed Matter Seminar

**Title** : Random walks, Bethe ansatz and Riemann's zeros.

**Speaker** : Giuseppe Mussardo (Scuola Internazionale Superiore di Studi Avanzati (SISSA), Italy)

**Date** : Wednesday, 30 July 2025

**Time** : 11:30 AM (IST)

**Abstract** : If the Riemann Hypothesis has fascinated mathematicians for decades, it has also fascinated theoretical physicists for quite a long time. The idea that a remarkable mathematical property may be understood from the simple and elegant requirements of a physical system is too appealing to pass up. "Understanding" is obviously different from "proving" but it may nevertheless be the first promising step toward a more rigorous approach. It is precisely with such a "theoretical physicist attitude" that we approach the famous problem of the alignment of all zeros of the Riemann and Dirichlet function along the axis $\Re s = \frac{1}{2}$. Firstly, we present a random walk approach, based on the aleatory nature of the Moebius coefficients evaluated on square-free numbers. The random nature of these coefficients (as well as of the Dirichlet characters evaluated on prime numbers) can be explicitly checked with astonishing accuracy. This statistical physics approach provides a natural explanation of the validity of the Generalised Riemann Hypothesis in terms of the universality of the critical exponents ½ of the random walk. Secondly, we show how the get the exact values of the imaginary part of the Riemann/Dirichlet zeros along the axis ½ in terms of the quantized energies coming from the Bethe Ansatz equations of a particle interacting with impurities spread on a circle.

**Venue** : Emmy Noether Seminar Room
Zoom Link: https://icts-res-in.zoom.us/j/97060580924?pwd=tLiOr9YlR5L7Fah9jpbC0ozbKL5twb.1
Meeting ID: 970 6058 0924
Passcode: 303031